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(71) Applicant
**T & N Materials Research Limited (United Kingdom),
20 St Mary's Parsonage, Manchester M3 2NL**

(72) Inventors
**John Dinsdale Crabtree
Robert Allan Lancaster
Adrian Michael Steer
D G Hall**

(74) Agent and/or Address for Service
**D D E Newman, R F Hadfield J A Crux,
PO Box 20, Ashburton Road West, Trafford Park,
Manchester M17 1RA**

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(54) **Fibre reinforced cement sheet**

(57) Fibre-reinforced cement sheet, especially in corrugated form, is made by the Hatschek or like layer-dewatering process from an aqueous cement slurry which contains reinforcing fibre, cellulosic web-forming fibre, ball clay, polyacrylamide flocculating agent, microsilica, and a polyacrylate thickening agent. The slurry preferably also contains pulverised fuel ash.

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SPECIFICATION

Manufacture of fibre-reinforced cement sheet

- 5 This invention relates to the manufacture of fibre-reinforced cement sheet. 5
- There is described in Turner & Newall Limited European Patent Application 12546 published in 1980 a process for the manufacture of fibre-reinforced cement sheet of the kind which entails de-watering on a water-permeable conveyor an aqueous cement slurry containing reinforcing fibres and cellulosic web-forming fibres, and subsequently setting the cement in the de-watered
- 10 slurry. According to the invention of that patent application, ball clay is included in the aqueous slurry in order to reduce the shrinkage that occurs during the later stages of setting of the binder (cement). Ball clay is a fine-grained, highly plastic, mainly kaolinitic clay, not to be confused with kaolin, a highly refractory clay which approaches the mineral kaolinite in chemical composition and structure but which, by contrast with ball clay, is hardly plastic at all. 10
- 15 EP 12546A also refers to the use of polyelectrolyte flocculant (specifically a polyacrylamide) in very small amounts (eg 0.1% by weight) to improve drainage of water from the web on the water-permeable conveyor and improve the retention of fine particulate raw material in it. 15
- Now, ball clay being a fine non-fibrous particulate material which is chemically inert to the alkaline environment which setting cement constitutes, its inclusion significantly reduces the strength which the set product would have in its absence. And if attempts are made to increase
- 20 strength by the incorporation of highly reactive silica in the slurry, particularly in the form of microsilica (silica of specific surface area at least 15m²/gram) to react with lime released during the early stages of setting, so that additional -O-Si-O- bonds are formed to strengthen the matrix, it is found that the ball clay—despite the presence of polyelectrolyte flocculant—tends to
- 25 remain separate from the other ingredients of the slurry and to cause the interstices of the water-permeable conveyor or felt to become blocked. 25
- We have now found that, in the process described above, products combining resistance to shrinkage with improved strength can be obtained by using, in conjunction with the polyacrylamide flocculant, a polyacrylate thickening agent.
- 30 The invention can be applied to the treatment of cement slurries which include the cheap diluent pulverised fuel ash, which reacts with lime released during the later stages of setting of the cement. 30
- The reinforcing fibres used may be any of the non-asbestos fibres conventionally employed, whether inorganic (eg alkali-resistant glass, carbon fibres) or organic (eg polyvinyl alcohol, polyacrylonitrile, polypropylene fibres).
- 35 The preferred cement slurries employed have the following composition: 35
- | | <i>% by weight of slurry solids</i> | |
|------------------------|-------------------------------------|----|
| Portland cement | 60-85 | |
| 40 pulverised fuel ash | 5-25 | 40 |
| microsilica | 5-15 | |
| cellulose fibre | 2-5 | |
| reinforcing fibres | 1-3 | |
| ball clay | 1-5 | |
- 45 The polyacrylamide flocculant and the polyacrylate thickening agent are each suitably employed in an amount of 0.01-0.1% by weight of slurry solids. 45
- The invention has particular application to the manufacture of corrugated cement sheet, and is further illustrated by the following Example, which utilises a Hatschek machine (as in EP 12546A)
- 50 and a corrugator, both of an entirely conventional type. 50
- Example*
- An aqueous cement slurry was prepared from the following ingredients:
- | | <i>% by weight of slurry solids</i> | |
|---------------------------|-------------------------------------|----|
| Portland cement | 68.5 | |
| pulverised fuel ash | 15 | |
| microsilica | 8 | |
| cellulose pulp | 3.5 | |
| 60 polyvinylalcohol fibre | 1.8 | 60 |
| ball clay | 3.2 | |
- The cellulose pulp was first dispersed in water to form a dispersion of 3% by weight solids content, which was passed through a disc refiner until its freeness was 65° Schopper Riegler.
- 65 The polyvinyl alcohol reinforcing fibre (length, 10mm; 2.4 denier) was then added with agitation, 65

- together with more water. The ball clay (60% by weight having particle size less than $0.5\mu\text{m}$; 70% having particle size less than $1\mu\text{m}$) was then added with agitation, followed first by the pulverised fuel ash, then the microsilica (specific surface area about $20\text{m}^2/\text{gm}$, added as an aqueous slurry of 50% by weight solids content), then the cement. This slurry was further
- 5 diluted with water to a solids content within the range 3–5%. Immediately before it was passed to the vat of the Hatschek machine, there was added to the slurry a mixture of the well known anionic polyacrylamide flocculating agent sold under the name MAGNAFLOC 1011 and the polyacrylate thickening agent sold under the name VISCALEX HV 30. Both these agents are products of Allied Colloids. The properties of the thickening agent VISCALEX HV 30 are set out
- 10 in Allied Colloids information sheet TPD 6004 ref 3811A/482A.
- Dosage rates for each agent were: 250 gms of solids per 1000 kg of slurry solids.
- The laminar product formed on the forming roll or 'bowl' of the Hatschek machine was slit axially, laid flat to form a sheet, and then shaped by the corrugator. The 'green' sheet obtained was set aside to cure for 28 days at ambient temperature.
- 15
- ### CLAIMS
1. A process for the manufacture of fibre-reinforced cement sheet by de-watering on a water-permeable conveyor an aqueous cement slurry containing reinforcing fibres, cellulosic web-forming fibres, ball clay, and polyacrylamide flocculating agent, and subsequently setting the
- 20 cement in the de-watered sheet, in which the aqueous slurry additionally contains microsilica and a polyacrylate thickening agent.
2. A process according to claim 1, in which the major ingredients of the slurry are as follows and are present in the proportions stated:
- | | | | |
|----|---------------------|-------|----|
| 25 | cement | 60–85 | 25 |
| | pulverised fuel ash | 5–25 | |
| | microsilica | 5–15 | |
| | cellulose fibre | 2–5 | |
| | reinforcing fibre | 1–3 | |
| 30 | ball clay | 1–5 | 30 |
3. A process according to claim 1 or 2, applied to the manufacture of corrugated fibre-reinforced sheet.
4. A process according to claim 1, substantially as herein described with reference to the
- 35 Example.